which, especially compared with that afforded by some other sciences, is relatively slight when the knowledge is elementary, increasing rapidly as the study becomes advanced. Further, while I have just urged that elementary physiology as an awakening study may be and indeed should be taught by itself, independent of other kinds of knowledge, I can now urge equally strongly that a study of physiology, beyond the mere elements, is impossible without a previous adequate knowledge of chemistry and physics. Again, while the practical teaching of the rudiments of physiology can be carried out anywhere and by any one, the further study of physiology demands no inconsiderable laboratory accommodation, complicated apparatus, and experiments on animals. Lastly, if the study of physiology is to be real, the whole body must be dealt with, no parts being excluded for special reasons ; and this means that the real study cannot be taken up until after puberty. For these reasons it seems to be undesirable to press the introduction of physiology into schools as an educational subject ; all the more so, since not only both chemistry and physics are admirably adapted for this purpose, but also a not inconsiderable knowledge of both these sciences is needed for the proper study of physiology ; and I imagine that by the time a boy or girl is thus prepared to study physiology, it is time that he or she should leave school.

While I am thus opposed to physiology being placed in a false position in the school curriculum, I feel myself all the more free to urge the very general introduction of an elementary study of the subject on account of its awakening value. I cannot define the amount of physiology which should thus be introduced more closely than by saying that the ground covered should be about that covered by my Primer. I would add that so far as is possible the pupils should *see* for themselves everything which is talked about in the lesson.

As to "physiology being a proper subject to be included among subjects for scholarship examinations for young pupils," I am so impressed with the painful evils of the present scholarship system, that I am most loth to say anything that would in any way lead to an addition to that system. If the scholarship examination is to be a test of education, of intellectual training, it is obvious from what I have said above, that physiology cannot be put on the same level with chemistry and physics. At the same time, if such subjects as physiology or botany are excluded from scholarship examinations, no little injustice, it appears to me, is likely to be done in the following way. A lad, let us say, shows an early bent towards physiology, and acquires at school a very considerable knowledge of its rudiments. His future career depends on his gaining a certain scholarship. If in the examination for that scholarship his place depends solely on the way in which he has acquitted himself in chemistry and physics, in which his interest is of a secondary character —he regarding them merely as helps to physiology—the world may be robbed of an eminent physiologist. Hence I would say that if the evil of a scholarship examination must come, I would give an opportunity of an elementary knowledge of physiology being, in some way, rewarded.

NOTES.

Prof. Ramsay has been good enough to forward to us the following translation of a passage in a letter he has recently received from Prof. Olszewski : "I have at last succeeded in determining the critical temperature and the boiling-point of hydrogen. I have found for the former −233° and for the latter −243°. I have used the dynamical method, which I described in the *Philosophical Magazine*. A thermal couple proved of no use, and I was obliged to avail myself of a platinum-wire thermometer, measuring the temperatures by the alteration in resistance of the wire. I have obtained satisfactory results, and intend to publish an account of them in English."

Mr. Frederick Webb has presented the sum of £1000 to the Medical School of St. George's Hospital, to found an annual prize in bacteriology.

Prof. Victor Horsley, F.R.S., has been elected into the Athenæum Club, under the provisions of the rule which empowers the annual election by the committee of nine persons "of distinguished eminence in science, literature, the arts, or for public services."

We are glad to learn that there is no foundation for the report of the death of Prof. H. Wild, of St. Petersburg, noted in these columns on February 28. The mistake arose owing to the announcement of the decease of a German investigator of the same name.

At the meeting of the Royal Irish Academy, on March 16, the following were elected honorary members. In the section of Science : Dr. Karl Weierstrass and Prof. du Bois Reymond, and Prof. E. Suess. In the section of Polite Literature and Antiquities : Prof. A. Erman, Dr. E. Zeller, Lieut.-General H. L. F. Pitt-Rivers, and Mr. S. R. Gardiner.

At the Paris Academy of Sciences last week, a bronze medal, engraved by Chaplain, was presented to M. Bertrand, in honour of his jubilee. The medal has on one side a likeness of M. Bertrand, and the reverse side bears the following sentiment : "To Joseph Bertrand, member of the French Academy, Perpetual Secretary of the Academy of Sciences, in honour of fifty years' devotion to science and education, from his pupils, admirers, and friends. March, 1844–1894."

The Anniversary Dinner of the Fellows of the Chemical Society will be held at the Hôtel Métropole on Wednesday, March 27, when Dr. Henry E. Armstrong, President of the Society, will occupy the chair. The Right Hon. A. J. Balfour, M.P., James Bryce, M.P., the Presidents of some of the learned Societies, and several other distinguished guests have accepted invitations to the dinner.

A number of organisations for scientific research in the leading cities of the American sea-board, including Philadelphia, Princeton, New York, Brooklyn, and Boston, have combined to organise an expedition to the west coast of Greenland. The expedition will be fitted out at Newfoundland, and will sail next June. Elaborate preparations are under way to insure important results to science. Each of the Societies participating will send a representative, including several who went last year, such as Profs. Libley and Chamberlin. The Brooklyn Institute will send a representative, to be chosen hereafter.

The death is announced of Mr. A. W. Beetham, at Dawlish, in his ninety-fifth year ; he was elected a Fellow of the Royal Society in 1835. We also notice the death of Mr. J. C. Smith, president of the Institution of Civil Engineers of Ireland ; of Dr. Hermann Grote, one of the most eminent experts in numismatics ; of Mr. G. N. Lawrence, a leading American ornithologist ; of General de Nasouty, founder and director of the Pic du Midi Observatory, which for twenty-one years has rendered great service to agriculturists in the French Pyrenees ; and of Prof. Julien Brunhes, at Dijon.

The Belgian Academy of Sciences offers a prize of 600 francs for the best essay on each of the following subjects :—(1) On the number of chromosomes before impregnation in an animal or a plant ; (2) On the Quaternary Flora, especially that of peat-bogs ; (3) Is there a nucleus in the Schizophyta? if so, what is its structure and its mode of division? The essay must contain a critical review of the publications existing on the subject. Each essay must be the result of original investigation.

THE Bologna Academy of Sciences offers a gold medal having the value of one thousand Italian lire (£40) as a prize to the author of a memoir which describes the best system or new apparatus for preventing or extinguishing fires, by chemical, physical or mechanical means. The competition is open to persons of all nationalities, and the memoirs must reach the Secretary of the Academy before the end of May, 1896. The descriptions should be written in Italian, Latin, or French, but memoirs will be permitted to compete if written in any other language, provided a translation in Italian accompanies them.

THE *Times* correspondent at Cairo reports that the Council of Ministers has approved Mr. Garstin's proposal for clearing Philæ of débris, in order to make a thorough examination of the bases of the temples, and explore the subterranean passages which intersect the island. This work, which is of high importance to the scientific world, will be done by the Public Works Department, an official from the Antiquities Department attending to insure that all objects of interest are preserved. The Ministry of War will be asked to lend Captain Lyons, R.E., to superintend the work.

THE United States Government is (we learn from the *British Medical Journal*) about to undertake an investigation of the climates of the country in connection with the indigenous diseases. The investigation will be conducted by the Weather Bureau of the Department of Agriculture, the Chief of which, Mr. Mark W. Harrington, has on many previous occasions given proof of an active interest in sanitary climatology. The precise manner in which the results of the investigation will be made public has not yet been decided upon, but it is hoped soon to publish a periodical devoted to climatology, and its relations to health and disease.

BY the consent of her Majesty the Queen, a piece of ground —the Palace Meadow—about four and a half acres in extent, has been ceded to the Royal Gardens at Kew, for the use of the public. The concession is a great convenience, for the removal of the fences will allow visitors to make a direct, instead of a circuitous, access to the finest part of the Arboretum. The Gardens are 251 acres in extent. It is not generally understood (says the *Kew Bulletin*) that they were originally the private property of the Crown, and not acquired out of public funds. The building used for the Herbarium and Library was sold to the nation by George IV. Access to the remainder has been step by step conceded to the public by the liberality of her Majesty the Queen.

The annual general meeting of the Italian Botanical Society will be held this year in Palermo, from April 16 to 23. The opportunity will be taken of celebrating the hundredth anniversary of the foundation of the Botanic Garden at Palermo.

ON Thursday next, March 28, Dr. E. B. Tylor, F.R.S., will deliver the first of a course of two lectures at the Royal Institution, on "Animism as shown in the Religions of the Lower Races." The Friday evening discourse, on March 29, will be delivered by Dr. H. E. Armstrong, F.R.S. His subject will be "The Structure of the Sugars and their Artificial Production."

THE Zoological Society of France held its second annual reunion on February 28, under the presidency of Prof. Léon Vaillant. The meeting was a marked success, a number of zoologists from all parts of France favouring the Society with original communications. It has been decided to make these annual conferences, to which all naturalists are cordially welcomed, a permanent feature, and to arrange in future for microscopical and other demonstrations, as well as numerous social gatherings.

WHEN the Council of the Zoological Society of France voted to support the movement for the establishment of an international bibliographical bureau, it charged one of its members, Prof. E. L. Bouvier, to present a report at the annual reunion of the Society. Basing its decisions upon this report, the Society has nominated a central Committee of Management, composed of the following titular members:—Dr. Raph. Blanchard, Prince Roland Bonaparte, Prof. Ives Delage, Prof. Henri Filhol, Prof. Albert Gaudry, Baron Jules de Guerne, Prof. A. Milne-Edwards, and Prof. A. Raillet. Twenty zoologists, residing in various parts of France, have been nominated as associate members. To complete the organisation, eleven special correspondents have been appointed, whose duty will consist in reporting to the Bureau such works as are inaccessible to it. A preliminary inquiry among the various scientific societies and the leading publishers has shown, however, that nearly all the zoological publications of France will be sent gratuitously to the Central Bureau. Not a single failure to accept this invitation to co-operate has thus far been reported.

THE annual meeting of the German Zoological Society will be held this year at Strassburg, on Tuesday, Wednesday, and Thursday, June 4 to 6. A preliminary general programme of the meeting has already been issued, and in the list of papers promised for the occasion we notice one by Prof. Goette, "On the Ancestry of the Vertebrata," and another by Dr. Bürger, "On Nemertines." The mornings will be devoted to general business and the reading of scientific communications and reports, and the afternoons will be reserved for demonstrations and the inspection of the laboratories. The meeting should possess considerable interest, and many will probably be glad to avail themselves of the cordial invitation which the Society extends to zoologists of other nationalities to attend the meeting as guests, and to take part in the proceedings of the Society.

THE Paris Geographical Society has awarded its prizes for 1895, as follows:—Gold medals, to Lieut. L. Mizon, for his explorations in West Africa; E Gautier, for his explorations in Madagascar; F. Foureau, for his explorations in the Sahara; E. Ponel, for his explorations in the region of the French Congo; Th. Moureaux, for his magnetic map of France; Father Colin, for his observations and triangulations in Madagascar; A. Courtry, for the production of a map of the Congo; V. de la Blache, for his general atlas; and Dr. Thoroddsen, for his explorations in Iceland. Silver medals have been conferred upon E. D. Poncins, for his journey from Turkestan to Kashmir by the Pamirs; J. Gaultier, for his works on the production of plans by photography; B. d'Attanoux, for his exploration in the Sahara; and J. Forest, for his studies on the breeding and habits of the ostrich in the Sahara. The Jomard prize has been awarded to L. A. Rainaud, for his memoir entitled "Le Continent austral: hypothèse et découverte."

SINCE the decision in the case of the Leeds Sunday Lecture Society, when it was held that the delivery of a lecture on a Sunday came within the meaning of the "Act for Preventing certain Abuses and Profanations on the Lord's Day, called Sunday," if the public were not admitted free, the Sunday Society has been exerting itself to procure an amendment of the vexatious Law as it now stands. Lord Hobhouse, who presided at a conference of Sunday Societies held last month, has introduced a Bill into the House of Lords for amending the Act in accordance with a resolution passed on that occasion. The Bill aims at securing that in future—"No action for the recovery of any penalty shall be commenced against any person in respect of the opening of any Museum, Art Gallery, Science or Art Exhibition, Garden or Library, as such, or the delivery of any lecture on science, literature, art, or kindred subject, or any recitation, or the giving of any performance of music, either vocal or instrumental, on Sunday, provided that the same take place under the management and control of a Society, Committee, or other body of persons, for the public advantage and not for pecuniary profit."

It is proposed to hold an International Exhibition at Atlanta, Georgia, U.S.A., from September 18 next, to December 31. The classification includes the usual departments of International Exhibitions, the following being the divisions:—Minerals and Forestry; Agriculture, Food and its accessories, Machinery and Appliances; Horticulture, Viticulture, Pomology, Floriculture, &c.; Machinery; Manufactures; Electricity and electrical appliances; Fine Arts, Painting, Sculpture, and Decoration; Liberal Arts, Education, Literature, Music, and the Drama; Live Stock, Domestic and Wild Animals, Fish, Fisheries, and Fish Culture; Transportation. The United States Government have given permission for exhibits to be brought in free of Customs' duties, unless the goods are entered for consumption in the States. Exhibits are invited from foreign countries on the usual conditions. Further information may be obtained from the Director-General, Mr. C. A. Collier, Piedmont Park, Atlanta, Georgia, U.S.A. Copies of the classification and general regulations have been sent to the Secretary of the Society of Arts, and can be seen at the Society's offices by any persons interested.

At a recent meeting of the Oriental Club of Philadelphia (Dr. D. G. Brinton writes in *Science*), Dr. J. P. Peters, whose researches among the ruins of the valley of the Euphrates are well known, mentioned his observations on the deposition of alluvium by the river as a chronometer for measuring the antiquity of some ruin-mounds. The deposits from the known date of Alexander's conquests display marked uniformity; and taking the depths of these as a standard, the foundations of Ur (the "Ur of the Chaldees" of Genesis, the modern Muchair) and of Eridu (the modern Abu-Shahrein) must have been laid about seven thousand years B.C.

A substitute for wood is badly wanted in the construction of warships. In the recent actions between the Chinese and Japanese fleets, several ships were disabled by serious fires on board, and this has caused much attention to be given to the invention of artificial wood, both at home and abroad. A Board of experts, says the *Journal* of the Franklin Institute for March, was lately convened by direction of the Secretary of the U.S. Navy to consider the subject of dispensing with wood in the construction of the naval ships now building, and also for the purpose of finding some suitable substitute for wood where it is impracticable to use metal. The Board has decided that a substitute for wood should be light, or not heavier than wood, non-conducting, non-combustible, and, when struck by shot, should not fly into splinters. Wood has the very objectionable property of splintering from the effect of shot; and the fact is well known that, in wooden ships, frequently as many persons are wounded by splinters as by shot.

A solution of the problem of finding a substitute for wood, seems, in the opinion of the Board, to lie in the following direction:—Select something in the nature of cheap wood or vegetable fibre and fine sawdust; treat them chemically with some insoluble fire-proof substance, not too heavy; then press and roll into boards, more or less dense, according to the use for which the material is desired. Such a material will be non-inflammable all through, will not splinter, will not be heavy, and will be a non-conductor. Possibly this artificial board can be strengthened by enclosing within it a tough, fine wire netting. If sawdust, or other fine cellulose material, after being rendered non-inflammable, can, by mixing with other materials not too heavy—or, if heavy, in small quantities—be applied to metal in a plastic state, so as to harden into a compact mass impervious to water, then it will be of great value. In other words, if a light, non-conducting, non-inflammable, insoluble cement can be discovered, it will be of great use in ship construction.

Numerous objects made of wood and covered with copper have been found during the exploration of mounds in Ohio. Prof. F. W. Putnam has described specimens of this kind, and copper objects sheathed with silver. The examples found are quite sufficient to show that the American aborigines in the Mississippi valley and in South America had the art of cold-hammering copper, of heating it to overlie and fit upon a warped or curved surface, and of turning the edges under. This process must not be confounded with the mere hammering-out of implements, nor with the process of making a sheet of copper as thin and uniform as a ship's sheathing, and then producing figures by rubbing or pressure. A note by Prof. O. T. Mason, in the *Proceedings* of the U.S. National Museum (vol. xvii. No. 1015), shows that the Haida Indians, who occupy the Queen Charlotte Islands, and are famous for their carved work, also cover wood and bone with copper. He describes two figures of humming-birds carved in wood, and having their wings and tails overlaid with a covering of sheet copper. The surfaces are neatly engraved with the conventional wing and eye signs of the Haidas. These specimens, and those from the mounds of Ohio, throw some light upon the processes employed by the aboriginal metallurgists of America.

It will be remembered that in June last, Prof. C. V. Riley resigned his position as Chief of the Division of Entomology of the United States Department of Agriculture, and was succeeded by Mr. L. P. Howard. Owing to these changes, the publication of *Insect Life*—the premier of entomological bulletins—appears to have ceased for a time. The periodical has, however, been revived, and three numbers of a new volume (vol. vii.), edited by Mr. Howard, have come to us, together with the last number of vol. vi., published under the joint editorship of Prof. Riley and Mr. Howard. Each of the numbers contains a store of information, in the form of articles or notes, on the life-habits of insects, especially in relation to agriculture. In one (vol. vi. No. 5) we notice an address on "Bees," by Prof. Riley, and in another (vol. vii. No. 1) we have an illustrated description of the senses of insects, by the same writer. The second number of the new volume is devoted to the proceedings of the sixth annual meeting of the Association of Economic Entomologists, held in August 1894. The presidential address delivered by Mr. Howard on that occasion, dealing with the rise and present condition of official economic entomology, shows what official encouragement is given to the investigation of insect problems in all parts of the world.

Most of the great advances in entomology have come from America, but, as Mr. Howard points out in the address referred to above, this progress would not have been possible without legislative encouragement. At the present time the amount of money expended for work in economic entomology is far greater in the United States than in any other country. There the regular annual expenditure in the support of entomological offices amounts to about one hundred thousand dollars. Probably the total sum expended annually in experiments and publications exceeds the entire amount expended in the same direction by the remainder of the world. No wonder, then, that the whole world looks to America for instruction in economic entomology. And the results obtained justify the money expenditure. Not a year passes, Mr. Howard remarks, in which the sum saved to agriculture and horticulture, as the direct result of the investigations of entomologists, does not amount to many times that which the United States Government grants. The results have thus added greatly to the productive wealth of the world, and this fact alone should be sufficient to lead our own Government to a more generous recognition of work in economic entomology.

Several German periodicals have published an account of a remarkable balloon ascent made in the "Phœnix" by Dr. A. Berson, on December 4 last. The balloon was inflated with 70,600 feet of hydrogen, and ascended from Stassfurt (Prussia) in the morning, taking a north-westerly direction, the weather at the time being somewhat misty. The temperature at first increased up to a considerable height; at 4900 feet the thermometer stood at 41°, and at 16,400 feet it read 0°, with a very dry air. At noon, an hour and half after starting, a height of 22,150 feet was reached, and the thermometer fell to −20°. At this time Dr. Berson began the artificial inhalation of oxygen, with excellent results. At about 29,500 feet the balloon passed through a veil-like stratum of cirrus clouds; these did not consist of ice crystals, but of perfectly formed flakes of snow. About two and a half hours after starting, a height of about 31,500 feet had been reached, the thermometer dropped to −54°, and indicated only −11° in the sun's rays; at this height Dr. Berson, being alone, thought it prudent to commence the descent. At 4600 feet the highest temperature was recorded, viz. 43°, and between this point and the earth it dropped to about 34°. The ascent occupied 3 hours, and the descent 2h. 20m., the balloon having travelled 186 miles, notwithstanding that the wind was almost calm on the surface of the earth. Dr. Berson obtained observations at a greater altitude than they had before been made; in Mr. Glaisher's celebrated ascent of September 5, 1862, the last actual observation was at 29,000 feet, although it is supposed that the balloon rose at least 7000 feet higher. The above particulars are taken from an account given in the *American Engineer* for this month.

About three years ago, the Botanic Garden at Cape Town was transformed into a town garden supported by municipal rates. A similar change has lately taken place at King William's Town, in the eastern province of the colony. The *Kew Bulletin* for March rightly condemns these changes, and the perfunctory manner in which botanic gardens in South Africa have generally been treated. It points out that, at the present moment, Cape Colony is the only important British possession which does not possess a fully-equipped botanical institution. It is true it possesses a fine colonial herbarium, under the competent charge of Prof. MacOwan, and an agricultural department which he efficiently advises on botanical subjects. But beyond this it has no central authority dealing with the practical aspects of the science of botany, and no gardens under technical control where careful experimental cultivation could be carried on, or where special seeds and plants could be obtained for starting new industries. This condition of affairs, the *Bulletin* holds, is scarcely credible to a large and wealthy community like that at the Cape. Something more than an ornamental garden, dotted here and there, is required in South Africa. A central establishment in the neighbourhood of Cape Town, devoted to the scientific study and experimental cultivation of plants, fully equipped to discharge its studies as a national institution on the lines of Kew, would alone be worthy of the future of South Africa. The flora of this part of the world is one of extreme interest. It deserves to be carefully and exhaustively studied, and numerous plants, now in danger of becoming extinct, should be preserved in some central spot for the observation of students. Of the economic influences of such a central institution it is needless to enlarge. There are hundreds of problems connected with the cultivation of industrial plants in South Africa awaiting solution, and these could only be dealt with at an institution specially devoted to scientific research, where careful trials could be conducted extending over many years.

In a recent publication by Dr. L. A. Bauer, entitled "Beitraege zur Kenntniss des Wesens der Saecular Variation des Erdmagnetismus" (Inaug. Diss., University of Berlin), some interesting and important contributions to our knowledge of that enigmatical phenomenon of terrestrial magnetism—the secular variation—have been made. The author has constructed the actual curve described in the course of centuries by the north end of a "free magnetic needle" at various stations (24) distributed over the globe. The result has been the establishment of a law governing the *direction* of the curve, which the author claims is the first law that has been established thus far with regard to the secular variation as applying to the whole earth. This law may be expressed as follows:—The north end of a freely suspended magnetic needle, as viewed from the point of suspension of the needle, moves, in consequence of the secular variation of terrestrial magnetism on the entire earth, in the direction of the hands of a watch. With regard to the period, Dr. Bauer believes that it has not yet been proved that the earth actually possesses a common secular variation period. The only way he thinks it possible to deduce a common period is by the supposition that the curve described by the magnetic needle is not a single closed one, but consists of loops. Indications of such loops, he says, make themselves apparent at various stations. A comparison is also drawn between the secular variation and the momentary distribution of terrestrial magnetism. A secular wave is followed around the earth with the aid of the projected curves. It would appear as though a continuation of the secular curve is obtained by going around the earth eastwardly. The fact thus revealed, the author says, would have, as a direct consequence, that if a survey be made along a parallel of latitude in an easterly direction, a similar motion of the magnetic needle would be encountered as in the case of the secular variation. Dr. Bauer has carried out this idea for three epochs, viz. 1780, 1829, and 1885, and along several parallels of latitude. The curves described by the needle are projected and given on a special plate. It has been found that in every case the north end of the needle, as observed from the centre of the needle, moves clockwise. Furthermore, by a comparison of both sets of curves—the secular and the momentary—it would appear as though they are subject to similar laws.

The method adopted in the Physikalisch-Technische Reichsanstalt for turning true spheres is described by Herr von Liechtenstein in the *Zeitschrift für Instrumentenkunde*. Three grinding cylinders, the diameter of which is less than that of the sphere, are mounted in a lathe, two of them being carried by one head and one by the other. They are disposed at angles of 120° to each other in a horizontal plane, and grasp the sphere between them. Their rotation produces a perfectly irregular motion of the sphere, and between the three cylinders it is ground to an extraordinary truth of figure. Iron and steel spheres of 25 mm. diameter thus produced showed errors of diameter not exceeding 0·0015 mm.

In the yearly report of the Russian Geographical Society, we notice that M. Roborovsky, chief of the Tibet expedition, has made a careful survey of the Lukchun depression, the level of which, as is known, lies below the level of the ocean. It appears that the depression has a length of nearly 100 miles, and an average width of 50 miles, and that its level is from 100 to 150 metres below the level of the sea. The desert which is situated in the south of it was crossed in several directions, and M. Roborovsky succeeded in obtaining no less than six specimens of the wild camel. After having reached Sa-chou, the expedition made extensive surveys in the Nan-shan highlands, and then it went out for the exploration of the country in the east of Lake Kukunor.

WITH reference to Mr. Culverwell's recent criticism of the astronomical theory of the Ice age, the Rev. O. Fisher (*Geol. Mag.* for March) quotes the opinion of the late Prof. Adams, expressed to him in a letter dated February 28, 1866. He says: "I do not myself believe in the change of eccentricity of the earth's orbit being a cause of climatal changes on the earth. The effect, if any, would depend only on the *square* of the eccentricity; and this always remains so very small, that I believe the effect on the earth's mean temperature would be almost insensible. Depend upon it, geologists who look in this direction for the cause of glacial epochs are entirely on the wrong track. It seems to me much more likely that the actual act of emission of heat from the sun is variable, than that the change of eccentricity of the orbit should have any sensible effect."

PROF. F. BRIOSCHI read before the Accademia dei Lincei, on March 3, a very full account of the life and works of the late Prof. Cayley, who was a Foreign Associate of the Academy.

A WORK almost entirely concerned with Insurance statistics is "Bourne's Handy Assurance Directory," now carried on by Mr. W. Schooling. Every one interested in statistical information relating to human life will find the volume useful.

IN the "Handbook of Jamaica" (Stanford) for 1895, compiled by Mr. S. P. Musson and Mr. T. L. Roxburgh, short biographical descriptions are given of the men of science who have been associated with the island, in addition to the historical, statistical, and general information concerning it.

THE number of the *Bulletin* of the Botanical Department, Jamaica, for January 1895, edited by the Director, Mr. W. Fawcett, is largely occupied with the insect enemies of the cocoa (*Theobroma*) and pine plantations, and some of the Coccidæ or scale-insects. It also contains a very interesting report on the services rendered in the island by the Botanical Department of Jamaica.

WITH the March number, *Science Progress* commences its third volume. Dr. E. Klein, F.R.S., contributes to the number an article on antitoxin, and Mr. J. E. Marr, F.R.S., summarises recent literature concerned with foreign work among the Precambrian and Palæozoic rocks. The subjects of the remaining articles are:—"Insular Floras," by Mr. W. B. Hemsley, F.R.S.; "Peptone," by Dr. W. D. Halliburton, F.R.S.; "Budding in Tunicata," by Mr. W. Garstang; and "The Reserve Materials of Plants," by Prof. J. R. Green.

THE first part of Mr. C. B. Moore's valuable report of his excavations in the prehistoric sand mounds of the St. John's River, Florida, was noticed in these columns last November (vol. li. p. 27). The second part, which has now reached us, contains the results of seven months' continuous work upon all the remains that could be found, and the complete report practically exhausts the study of the mounds on the banks of the St. John's River; for the river has been explored from the source to its outlet. The mounds described in the part of the report before us are, perhaps, not quite so interesting as those of which an account was given in the former part, but this does not diminish their value to archæologists. Future workers among the mounds will find that all the objects found are recorded, instead of merely the rare ones, and those of unusual workmanship. The flint implements, curious types of earthenware, and human remains described, and finely illustrated, furnish material for much scientific study. The Philadelphia Academy of Sciences, in the *Journal* of which (vol. x.) Mr. Moore's report appears, deserves much credit for the admirable illustrations.

METEOROLOGISTS and physicists have reason to be grateful to Mr. S. P. Langley for the valuable series of numerical tables which he has projected, to take the place of a series of meteorological tables compiled by Dr. Arnold Guyot, and published by the Smithsonian Institution in 1852. Dr. Guyot's tables were widely used and appreciated, but the new series will be of even greater service. The work will be completed in three parts: Meteorological Tables, Geographical Tables, and Physical Tables. The first of these volumes appeared in 1893; the second (Smithsonian Miscellaneous Collections, No. 854) lies before us. This has been prepared by Prof. R. S. Woodward, whose experience in geodetic work particularly qualifies him for the task. The introductory part of the volume is divided into seven sections, under the heads: useful formulæ, mensuration, units, geodesy, astronomy, theory of errors, and explanation and use of tables. This section takes up a hundred pages, after which come tables running into one hundred and eighty pages. Every effort appears to have been made to avoid errors, and Prof. Woodward has made a judicious selection of matter from a vast amount of available material. It requires no great prophetic instinct to say that his compendium will be prized by geographer and meteorologist, as a standard work of reference.

THE Meteorological Society of Berlin has published its Report for the year 1895; the Society holds monthly meetings between October and May, and a summary of the papers read is regularly printed in our columns. Prof. Hellmann, the President, appends to the Report a discussion of the wind velocity at Berlin from ten years anemometrical observations. The principal maximum, in the yearly period, falls in March, and the minimum in September; in the daily period, the maximum throughout nearly the whole year occurs between 1h. and 2h. p.m., with a tendency to a second maximum during the night in the cold season. The greatest hourly velocity recorded was fifty miles an hour, which is about half the rate that has been registered in the greatest storms on our own coasts.

WE have received from Dr. Henry Bovey a paper of high technical value, containing the results of numerous experiments which have been carried out in the testing laboratories of the McGill University, on the strength of Canadian Douglas fir, red pine, white pine, and spruce. The tables given tend to prove that timber, unlike iron and steel, may be strained to a point near the breaking-point without being seriously injured. In almost all cases the increments of deflection and extension, almost up to the point of fracture, are very nearly proportional to the increments of load, thus showing that it is difficult to define a limit of elasticity for timber. This, Dr. Bovey thinks, probably accounts for the continued existence of many timber structures of wood in which the timbers have been, and are still, continually subjected to excessive stresses, the factor of safety being often less than one and a half. Whether it is advisable so to strain timber is another question, and experiments are still required to show how wood is affected by frequently repeated strains.

A FURTHER memoir concerning the interesting sodium derivative of nitro-ethane, and the sodium compounds of nitro-paraffins generally, is contributed by Prof. Victor Meyer to the *Berichte* of the German Chemical Society. The nature of these unstable compounds has not hitherto been satisfactorily determined, for in a communication to the *Annalen der Chemie*, J. U. Nef, some time ago, stated that they do not partake of the nature of true derivatives of nitro-paraffins, but contain an altogether differently constituted organic residue. The experimental evidence adduced in support of this view consisted chiefly of the observation which he made that the parent nitro-paraffin was not, or only to a slight extent, regenerated upon treating the sodium compound with dilute sulphuric acid, the compound being decomposed with evolution of nitrous oxide and formation of an aldehyde or ketone. Prof. Meyer has made further experiments in this direction, and their results definitely fix the nature of these sodium compounds, proving that they are indeed true sodium derivatives of the nitro-paraffins, being formed by the replacement of one of the hydrogen atoms of the alkyl radicle by sodium. It is a fact that when sodium nitro-ethane, $C_2H_4NaNO_2$, is dissolved in excess of dilute sulphuric acid at the ordinary temperature, a somewhat vigorous evolution of nitrous oxide occurs. But if the most elementary precautions are taken to prevent the decomposition of so unstable a substance by the thermal change involved in so energetic a reaction, the decomposition proceeds quite differently. If the sodium compound is first dissolved in a little water well cooled by ice, and then an equivalent added of dilute sulphuric acid similarly cooled to near 0°, only a very few bubbles of gas escape, and barely a trace of the odour of aldehyde is perceptible, while a layer of oil, consisting of nitro-ethane, separates out. Even after the operations of purification, which involve some loss owing to the volatility of nitro-ethane, over 60 per cent. of the theoretical quantity of the pure nitro-paraffin was isolated. Moreover, the small quantity of decomposition indicated by the few bubbles of nitrous oxide can be entirely avoided by employing acetic instead of sulphuric acid; the reaction is then less vigorous, and consequently produces at temperatures not far above 0° no dissociation of the nitro-paraffin. The observation of Nef, that the sodium derivatives of the nitro-paraffins are decomposed at the ordinary temperature by the stronger acids, even when diluted, into nitrous oxide and an aldehyde or ketone, is an interesting one; but Prof. Meyer's work now shows that this is due merely to the fact that the nitro-paraffin first regenerated is decomposed in all probability by the heat of the reaction between the sodium and acid, and that when the precaution is taken to prevent this rise of temperature by reacting with ice-cold solutions, the regenerated nitro-paraffin remains intact. Hence it must be concluded that the sodium compounds are true derivatives of the nitro-paraffins which can thus be regenerated from them.

The additions to the Zoological Society's Gardens during the past week include a Vervet Monkey (*Cercopithecus lalandii*, ♀) from South Africa, presented by Captain Scarlett Vale; a Macaque Monkey (*Macacus cynomolgus*, ♂) from India, presented by Miss K. Fleming; a Vulpine Phalanger (*Phalangista vulpina*) from Australia, presented by Mr. Richmond Allen; a Grey Ichneumon (*Herpestes griseus*) from India, presented by Mrs. Lewis; fifteen —— Rats (*Mus*, sp. inc.) from Sunday Island, Kermadee Group, presented by the Countess of Glasgow; a Hooded Finch (*Spermestes cucullata*) from West Africa, a Chestnut-eared Finch (*Amadina castanotis*) from Australia, presented by Mr. C. H. Hastings; a Woodcock (*Scolopax rusticula*), British, presented by Mr. Charles Smoothy; a Long-necked Chelodine (*Chelodina longicollis*) from Australia, deposited; four Marbled Newts (*Molge marmorata*), European, purchased.

OUR ASTRONOMICAL COLUMN.

PARTIAL ECLIPSE OF THE SUN, MARCH 26.—On March 26 a small partial eclipse of the sun will, if the weather be favourable, be seen from all parts of the British Isles, with the probable exception of places which are to the east of a line joining Lowestoft and Hastings. At Greenwich the magnitude of the eclipse, sun's diameter = 1, will be 0·013, and the first contact will occur at 9.56 a.m., with a duration of only 27 minutes. At Oxford the magnitude will be 0·03, and the duration 40 minutes. At Dublin the magnitude will be 0·09, with a duration of 67 minutes, and at Edinburgh 0·08, with a duration of 62 minutes. The eclipsed part will be a maximum (0·36) as seen from the north-east of North America.

In the *Nautical Almanac* for the current year the eclipse is said to be *invisible* at Greenwich, but the error was corrected in the *Almanac* for 1897. The mistake, however, has not been corrected in many of the almanacs in common use.

DISTRIBUTION OF MINOR PLANETS.—An interesting diagram has been constructed by General Parmentier, to show the distribution of the minor planets at present known between the orbits of Mars and Jupiter (*Bulletin Soc. Ast. de France*, March). Of the 390 planets for which sufficient data are available, 93 have a mean distance between 2·16 and 2·48; 152 between 2·52 and 2·82; 128 between 2·85 and 3·25; and 10 between 3·38 and 3·48. The interval between Brucia (at 2·16) and Mars, is occupied by a single asteroid, comparatively recently discovered, with a mean distance of 2·09. On the outer side of the dense swarm, there are only six minor planets in a zone very nearly as wide as that occupied by the group of 383, and extending to a mean distance 4·68. The region of greatest density of the asteroids so far discovered is at a mean distance from the sun very nearly equal to that indicated by Bode's law (2·80); Ceres, Pallas, and Juno fall a little short of this distance.

At the present rapid rate of discovery of minor planets by the photographic method, data will no doubt soon be available to determine if the outer zone between Camilla and Jupiter is really an almost deserted region.

THE ROYAL OBSERVATORY, EDINBURGH.—We are glad to hear that the new National Observatory for Scotland is making rapid progress towards completion. The buildings are quite finished so far as the outside is concerned, and it is hoped that the two equatorials and the transit instrument will be erected in the early summer. The library will be ready to receive the magnificent collection of twenty thousand volumes as soon as the heating arrangements are completed.

PHYSICAL WORK OF HERMANN VON HELMHOLTZ.[1]

II

KÖNIG has shown that in many cases, when two notes are sounded simultaneously, beats are heard, as though the most prominent phenomenon was the production of beats not between the two fundamental notes, but between the upper of these, and the nearest partial of the lower note. Inasmuch as these beats are heard when the lower note (as far as can be tested) is free from upper partials, this rule is not the explanation of the phenomenon, but it is a convenient way of expressing the results. In the experiment just described, the frequencies of the two notes were in the ratio 12 to 15. The first partial of the lower note (12) is therefore the nearest to the higher tone; that is to say, König's beat tone and the first difference tone are identical.

It is easy to arrange an experiment in which these conditions are not fulfilled. Thus let the notes be in the ratio 9 : 15. The second partial of the lower note is 18, which is nearer to 15 than to 9; hence the König beat-tone would have a relative frequency of $18 - 15 = 3$. If the siren rotates 10·6 times per second, the frequencies of the two fundamental notes are $9 \times 10{\cdot}6 = 96$ and $15 \times 10{\cdot}6 = 160$ respectively. As before, the difference tone is 64.

In this case we can use another method of determining the speed of the siren. In 1880 Lord Rayleigh constructed an instrument in which the mass of air enclosed in a tube is excited by resonance, and the fact of the excitation is indicated by a light mirror, which is set where the motion is greatest, inclined at 45° to the direction of the air-currents. In accordance with the general law that a lamina tends to place itself perpendicular to the direction of a stream, the mirror moves when the air vibrates. In the original apparatus the amount of the movement was controlled by magnets. Since that date Prof. Boys has modified the instrument by substituting a quartz thread suspension for a silk fibre, and using the

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[1] A discourse delivered at the Royal Institution, by Prof. A. W. Rücker, F.R.S., on Friday, March 8. (Continued from page 475.)